



HEAVY EQUIPMENT SCIENCES

Program of Studies
2015-2016



HEAVY EQUIPMENT SCIENCES

Course Title	Post-Secondary Connection	Valid Course Code	Recommended Grade Level				Recommended Credit
Basic Blueprint Reading	BRX 120	499920	X	X	X	X	.5
Basic Troubleshooting		499925	X	X	X	X	1
Heavy Equipment Operation	HEO 151	460404	X	X	X	X	1 to 5
Heavy Highway Construction Equipment Repair	DIT 103	460403	X	X	X	X	1 to 5
Industrial Education Co-op		499910			X	X	1 to 3
Industrial Education Internship		499915			X	X	1 to 3
Industrial Safety	ISX 100	499930	X	X	X	X	.5
Introduction to Construction Technology	CAR 126/127	460201	X	X	X	X	1
Special Topics – Heavy Equipment	HEO 125	460499	X	X	X	X	.5 to 1

CONSTRUCTION HEAVY EQUIPMENT SCIENCES

Program Description

The Heavy Equipment Sciences program will prepare students not only on regular construction building jobs, but also on infrastructures projects (roads, bridges, and ports, otherwise called non-building construction), and in mining and timber operations. A trained and experienced equipment operator provides necessary skills for any project that requires moving and transporting heavy materials, or that demands any kind of earthmoving.

Program completion may lead to placement in an apprenticeship program and/or admission to a postsecondary program. Students will have the opportunity to train at construction sites through work-based learning and student projects. Current and traditional building practices, which meet industry standards, include energy efficient construction, health and safety at the workplace, and maintenance of existing structures.

Students will learn the safe and proper use of tools, equipment, and techniques used in the construction industry. Formative and summative assessments will be used to determine student proficiency in hand and power tool operation. Students will complete hands-on projects on Civil Blueprint Reading, soils, and Paving.

Course offerings promote career opportunities for those entering the industry. There are multiple options available for program completers which may include apprentice, heavy equipment operator, heavy construction equipment technician, heavy construction equipment operator, foreman, and engineer or project manager with additional post-secondary course work. Articulation agreements with post-secondary institutions are available for college credit during or after program completion. After completing the program Students are eligible to take the NCCER Heavy Equipment Operations (HEO) level 1 certification.

The Heavy Equipment Sciences Program prepares students for high-skill, high-wage, and high-demand careers.

Sample: KENTUCKY CAREER PATHWAY/PROGRAM OF STUDY 2015-2016

COLLEGE/UNIVERSITY:		College / State University			CLUSTER:	Construction			
		KCTCS Community College			PATHWAY:				
HIGH SCHOOL (S):		KY ATC/CTC/High School			PROGRAM:	Heavy Equipment			
	GRADE	ENGLISH	MATH	SCIENCE	SOCIAL STUDIES	REQUIRED COURSES RECOMMENDED ELECTIVE COURSES OTHER ELECTIVE COURSES CAREER AND TECHNICAL EDUCATION COURSES		CREDENTIAL CERTIFICATE DIPLOMA DEGREE	SAMPLE OCCUPATIONS
SECONDARY	9	English I	Algebra I	Earth Space Science	World History	Health and PE	Technical Elective	ISX 100 Industrial Safety 499930	
	10	English II	Geometry	Biology I	World Civics	History and Appreciation of Fine Arts	CAR 126/127 Intro to Constr. Tech460201	DIT 103 Heavy Highway Constr Equip	
	11	English III	Algebra II	Physics or Chemistry	U.S. History	Foreign Language	HEO 151 Heavy Equip Operation 460404	HEO 125 Special Topics heavy	
	12	English IV	Math Elective	Computer Aided Drafting (elective)	World Geography		Internship 499915	Co-op 499910	NCCER Equipment Operator Level 1
POSTSECONDARY	Year 13	ENG 101 Writing I	MT 110 Applied Mathematics	ASTR 104 Astronomy	College Chemistry	PSY 100 Intro Psychology	HEO 201/251 Heavy Equipment Operations	Occupation Safety	Construction Heavy Equipment
	Year 14	ENG 200 Intro/Literature	Math 200	WLD 221 Certification Lab	HIS 109 US History	CAR 140 Surveying & Foundations	Materials Science	HEO 111 Bulldozer Operator	Associates Degree in Applied Science
	Year 15	ENG 200 Intro/Literature	MAT 250 CALCULUS	PHY 236 UNIV. PHYSICS I	CIV 102 WORLD CIV. II	PHY 195 METHODS OF ENG. PHYSICS	CIV 102 WORLD CIV. II	CAD 200 Intermediate Computer Aided design	
	Year 16	PHY 140 INTRO. COMPUTING APPS.	MAT 308 CALCULUS II	PHY 259 STATICS	MAT 309 CALCULUS III	MAT 411 DIFFERENTIALS EQTNS.	TECHNICAL ELECTIVE	PHY 330 DYNAMICS	
	Year 17	PHY 344 FLUID MECHANICS	PHY 370 INTRO. MODERN PHYSICS	CHE 201 GEN. COLLEGE CHEM. I	HUM 211 HUMANITIES	ITD 102 CAD APPLICATIONS	PHY 346 HEAT TRANSFER	PHY 375 MATERIALS SCIENCE	PHY 390 ENGR. MEASUREMENT
	Year 17	PHY 359 MECHANICS OF MATERIALS	PHY 470 OPTICS	PHY 498 SENIOR ENGR. DESIGN I	ECO 231 PRINC. OF MICROECONOMICS	PHY 499 SENIOR ENGR. DESIGN II	TECHNICAL ELECTIVE	MAT DEPTH ELECTIVE	FREE ELECTIVE
								BACHELORS DEGREE ENGINEERING	Western Kentucky UNIVERSITY
									ENGINEER
Other Elective Courses									
Career and Technical Education Courses									
Credit-Based Transition Programs (e.g. Dual/Concurrent Enrollment, Articulated Courses, 2+2+2)									
(♦=High School to Comm. College) (• =Com. College to 4-Yr Institution) (■ = Opportunity to test out)									
Mandatory Assessments, Advising, and Additional Preparation									
TECHNICAL COLLEGE CREDIT GIVEN THROUGH THE KCTCS DUAL ENROLLMENT PROGRAM									
Certificate given through the Warren County Area Technology Center									
Degree given through the Bowling Green Technical College KCTCS									
DEGREE GIVEN THROUGH THE MURRAY STATE UNIVERSITY									

Funded by the U. S. Department of Education
(V051B020001)
Revised Jan. 2005
October, 2006-CTE/Kentucky



CCTI

College and Career Transitions Initiative

***HEAVY EQUIPMENT SCIENCES
CAREER PATHWAY
2015-2016***

**Heavy Equipment Sciences
CIP 49.0202.01**

PATHWAY DESCRIPTION:

The Heavy Equipment Sciences program will prepare students for construction building jobs, infrastructures projects (roads, bridges, and ports, otherwise called non-building construction), and in mining and timber operations. A trained and experienced equipment operator provides necessary skills for any project that requires moving and transporting heavy materials, or that demands any kind of earthmoving.

BEST PRACTICE CORE

**EXAMPLE
ILP-RELATED
CAREER TITLES**

*Foundational Skills Necessary for Career-Ready Measure:
(KOSSA/Industry Certification)*

*Complete (3) **THREE CREDITS:***

- 460201 Introduction to Construction Technology
- 460403 Heavy Highway Construction Equipment Repair
- 460404 Heavy Equipment Operations

*Complete (1) **CREDIT** from the following:*

- 460499 Special Topics – Heavy Equipment
- 499925 Basic Troubleshooting

Note: (*) Indicates half-credit courses

Heavy Equipment
Operator

COMPLIMENTARY OR ADVANCED COURSEWORK BEYOND CONSTRUCTION/CARPENTRY TECHNOLOGY PATHWAY(s)
Upon completion of a pathway, additional coursework to enhance student learning is encouraged. Credits earned in Advanced or Complimentary Coursework “Beyond the Pathway” may not be substituted for pathway courses in order to achieve Preparatory or Completer status.
<ul style="list-style-type: none">• 499920 Basic Blueprint Reading
<ul style="list-style-type: none">• 499910 Industrial Education Co-op
<ul style="list-style-type: none">• 499915 Industrial Education Internship
<ul style="list-style-type: none">• 499930 Industrial Safety
<ul style="list-style-type: none">• Career Options
<ul style="list-style-type: none">• JAG Courses

Basic Blueprint Reading

499920

Course Description

This course presents basic applied math, lines, multitier drawings, symbols, various schematics and diagrams, dimensioning techniques, sectional views, auxiliary views, threads and fasteners, and sketching typical to all shop drawings. Safety will be emphasized as an integral part of the course.

Content/Process

1	<p>Basic Blueprint Reading:</p> <ul style="list-style-type: none"> a) Introduction and math review (fractions and decimals) b) Demonstrate the use of size and location dimensions c) Locate dimensions for centering of holes, points, and centers d) Identify the alphabet of lines e) Identify multiple views f) Arrange multiple views g) Arrange two-view drawings h) Identify one-view drawings i) Sketch and dimension shop drawings j) Calculate tapers and machined surfaces k) Demonstrate proper dimensions of cylinders and arcs l) Size dimensions of holes and angles m) Dimension parts using shop notes n) Calculate tolerances o) Identify labeling of various screw threads p) Arrange and identify auxiliary views q) Interpret the base line dimensions on drawings r) Identify half, full, and removed sections s) Interpret ordinate and tabular dimensions t) Sketch parts with irregular shapes u) Set tolerances using geometric dimensioning techniques v) Sketch oblique views of various parts w) Identify electrical schematic and diagram symbols x) Identify welding symbols and equipment y) Interpret connections and flow of various electrical, hydraulic, and pneumatic schematics and diagrams 	
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Connections:

*Common Core State Standards

*KOSSA

*Common Core Technical Standards

*New Generation Science Standards

*Post-Secondary: KCTCS BRX 120

*CTSO—SkillsUSA

Basic Troubleshooting

499925

Course Description

This course explores the science of troubleshooting and the importance of proper maintenance procedures; how to work well with others, aids in communication, and trade responsibilities; examines actual troubleshooting techniques, aids in troubleshooting, and how to use schematics and symbols; focuses on specific maintenance tasks such as solving mechanical and electrical problems, breakdown maintenance, and the how's and whys of planned maintenance.

Content/Process

1

Basic Troubleshooting:

- a) Explain the reason efficient troubleshooting is important, including pre-operation checks
- b) Demonstrate good communication skills
- c) List the steps in troubleshooting a machine/system
- d) List the questions that should be asked when a machine system fails
- e) Identify a pictorial diagram, a blocking diagram, and a schematic diagram
- f) Use schematics when troubleshooting
- g) Identify differences in schematics when troubleshooting
- h) Use a troubleshooting chart
- i) Identify current voltage characteristics of wire
- j) Demonstrate how to troubleshoot an electrical problem
- k) Identify bearing wear problems
- l) Identify pump failure problems and solutions
- m) Identify types of hosing
- n) List the information that should be recorded in a machine equipment record
- o) Identify calibration standards
- p) List preventive maintenance procedures
- q) List the signs of a machine in need of service
- r) List the questions that should be asked when a machine/system fails
- s) Identify different troubleshooting test equipment
- t) Apply all safety rules when working with electrical equipment

Connections:

*Common Core State Standards

*KOSSA

*Common Core Technical Standards

*New Generation Science Standards

*Post-Secondary: KCTCS BRX 120

*CTSO—SkillsUSA

Heavy Equipment Operation

460404

Course Description

This course introduces students to the basic terminology and equipment used in the heavy equipment trade; working around heavy equipment in a safe and responsible manner; commonly used heavy equipment machines, including dump trucks, trenchers, backhoes, excavators, skidsters and dozers; drive systems and hydraulic systems; pre-operational checks and operator maintenance tasks for heavy equipment; basic tractor operation, controls, attachments, maintenance, and safety guidelines; basic concepts and procedures related to the use of heavy equipment to perform earthmoving work; preparing graded surfaces using heavy equipment; identification and interpretation of construction stakes; and describes the methods for grading slopes. Students will learn what tasks are expected from an apprenticeship program in heavy equipment.

Content/Process

Heavy Equipment Operation:

- a) Explain Basic terminology, types, and uses of equipment
- b) Identify career opportunities available to heavy equipment operators and explain the purpose and objectives of an apprentice training program.
- c) Explain the responsibilities and characteristics of a good operator.
- d) Explain the importance of heavy equipment safety.
- e) Demonstrate how to use various types of personal protective equipment (PPE)
- f) Place barricades and temporary traffic control devices for a highway construction zone.
- g) Demonstrate how to use flags or paddles to control traffic
- h) Identify the various types of heavy equipment and their uses.
- i) Perform basic prestart inspection, startup, operational movement, and shutdown for different heavy equipment.
- j) Properly start, warm up, and shut down a gasoline-powered and diesel-powered engine tractor.
- k) Perform basic maneuvering with a tractor.
- l) Attach implements to a drawbar and three-point hitch.
- m) Attach and detach implements to a power takeoff.
- n) Draw a plan for basic earthmoving operations
- o) Lay out a basic earthmoving operation.
- p) Identify and select the proper equipment for a given earthmoving operation.
- q) Identify types of stakes and markings on stakes.
- r) Check horizontal and vertical distances of cut and fill slope stakes.
- s) Check finish subgrade on a cross slope.

Connections:

*Common Core State Standards

*KOSSA

*Common Core Technical Standards

*New Generation Science Standards

*Post-Secondary: KCTCS BRX 120

*CTSO—SkillsUSA

Heavy Highway Construction Equipment Repair

460403

Course Description		
This course introduces students to perform preventive maintenance, diagnose malfunction, prescribe corrective actions, and repair heavy highway equipment.		
Content/Process		
1	Heavy Highway Construction Equipment Repair: <ul style="list-style-type: none">a) Identify the basic parts of each type of equipment and explain the differences in models of type of equipment.b) Identify and explain the systems that make up the drive system used on heavy equipment.c) Explain the basics of a hydraulic system and identify hydraulic components.d) Describe the different types of transmissions used on utility tractors.e) Perform prestart inspection and maintenance procedures.f) Inspect different types of heavy equipment.g) Perform preventive maintenance.h) Diagnose malfunction.i) Prescribe corrective action.j) Repair machinery used in construction, farming, rail transportation, and other industries.	
Connections: <ul style="list-style-type: none">*Common Core State Standards*KOSSA*Common Core Technical Standards*New Generation Science Standards*Post-Secondary: KCTCS BRX 120*CTSO—SkillsUSA		

Industrial Education Co-op

499910

Course Description		
Cooperative Education for CTE courses indicated within the KY Department of Education provides supervised work site experience related to the student's identified career major. Students who participate receive a salary for these experiences, in accordance with local, state and federal minimum wage requirements..		
Content/Process		
1	Industrial Education Co-op <ul style="list-style-type: none"> a) Gain career awareness and the opportunity to test career choice(s) b) Receive work experience related to career interests prior to graduation c) Integrate classroom studies with work experience d) Receive exposure to facilities and equipment unavailable in a classroom setting e) Increase employability potential after graduation f) Earn funds to help finance education expenses 	
Connections: *Common Core State Standards *KOSSA *Common Core Technical Standards *New Generation Science Standards *Post-Secondary: KCTCS BRX 120 *CTSO—SkillsUSA		

Industrial Education Internship

499915

Course Description		
<p>Internship for CTE Courses provides supervised work-site experience for high school students who have completed courses leading to a career pathway. Internship experiences consist of a combination of classroom instruction and field experiences. Students receiving pay for intern experience are those participating in an experience that is a semester or longer and have an established employee-employer relationship. A non-paid internship affects those students who participate on a short term basis.</p>		
Content/Process		
1	<p>Industrial Education Internship</p> <ul style="list-style-type: none">a) Gain career awareness and the opportunity to test career choice(s)b) Receive work experience related to career interests prior to graduationc) Integrate classroom/lab studies with work experienced) Receive exposure to facilities and equipment unavailable in a classroom settinge) Increase employability potential after graduation	
<p>Connections:</p> <ul style="list-style-type: none">*Common Core State Standards*KOSSA*Common Core Technical Standards*New Generation Science Standards*Post-Secondary: KCTCS BRX 120*CTSO—SkillsUSA		

Industrial Safety

460301

Course Description		
This course provides practical training in industrial safety. The students are taught to observe general safety rules and regulations, to apply work site and shop safety rules, and to apply OSHA regulations. Students are expected to obtain certification in first aid and cardiopulmonary resuscitation.		
Content/Process		
1	Industrial Safety: <ul style="list-style-type: none">a) Apply work site and lab safety proceduresb) Apply personal safety rules and proceduresc) Apply fire prevention rules and proceduresd) Obtain first aid certificatione) Obtain CPR certification (Recommended but not required)f) Demonstrate hazardous communications proceduresg) Describe and demonstrate universal precautions proceduresh) Obtain OSHA 10 certification (recommended but not required)	
Connections: <ul style="list-style-type: none">*Common Core State Standards*KOSSA*Common Core Technical Standards*New Generation Science Standards*Post-Secondary: KCTCS ISX 100*CTSO --SkillsUSA		

Introduction to Construction Technology

460201

Course Description		
This course is the introduction to the construction carpentry industry. The class will emphasize safe and proper methods of operating hand tools, portable power tools, and stationary power tools in the construction industry.		
Content/Process		
	<p>Introduction to Construction Technology:</p> <ul style="list-style-type: none">a) Identify the proper use of personal protection equipment and general job safetyb) Identify and use various types of building materialsc) Identify and use various types of fasteners, anchors, and adhesives used in the construction industryd) Identify the actual and nominal sizes of lumbere) Perform mathematics functions as related to tasks being performedf) Demonstrate the safe and proper use of the following types of hand tools: fastening devices, layout and measuring devices, leveling devices, edge cutting devices, etc.g) Demonstrate the safe and proper use of the following types of portable power tools: various saws, surfacing and shaping tools, drills, pneumatic tools, etc.h) Demonstrate the safe and proper use of the following stationary power tools: various saws, drill press, surfacing and shaping tools, drills, pneumatic tools, etc.i) Build a project using tools of the trade: sawhorse, shop bench, tool box, picnic table	
<p>Connections:</p> <ul style="list-style-type: none">*Common Core State Standards*KOSSA*Common Core Technical Standards*New Generation Science Standards*Post-Secondary: KCTCS CAR 126/127*CTSO's--SkillsUSA		

Special Topics – Heavy Equipment

460499

Course Description		
Instruction related to Industrial Education - Heavy Equipment but not described in the above courses.		
Content/Process		
1	Special Topics – Heavy Equipment a) Selected tasks/problems as determined by the instructor	
Connections: *Common Core State Standards *KOSSA *Common Core Technical Standards *New Generation Science Standards *Post-Secondary: KCTCS BRX 120 *CTSO—SkillsUSA		